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Integrated **P**est **M**anagement

... a look to the future

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Integrated Pest Management -- A Look to the Future 61220

by

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Before 1945, pest losses on livestock, crops, and home gardens were enormous. Pests limited agricultural production and degraded the esthetic values of our environment. Farmers went to work by sunrise and did not leave the fields until dusk--as agriculturalists have done for centuries. Farmers and home gardeners were restricted to a few pesticides such as arsenic and paris green. They relied heavily on hand plucking of insects and other century old labor-intensive methods of pest control. Shrubs and home lawns consisted mainly of a few cultivars and native species that survived pest attack. Except for those of the very wealthy, home lawns and shrubs were unthrifty and unattractive. Swept yards (dirt) were commonplace in much of rural America.

All this changed in the 1940's and 1950's with the advent of modern pesticides and with vast improvements in crop varieties, introduction of exotic species of plants, a rising economy, increased mechanization, higher fertility practices, improved irrigation systems, and above all, unprecedented good weather for agriculture.

Extension educational programs on pest control contributed greatly to this beauty and agricultural abundance. Midway in this period that came to be known as the "pesticide treadmill," Extension agents and specialists were among the first to observe and sound the alarm that there were problems with pesticides. They pointed out to researchers and others that insects and diseases were becoming resistant to modern pesticides. Application dosages had to be increased and the interval between applications shortened. Many nontarget organisms were being affected by pesticides.

Agricultural scientists began to define the problem and develop solutions. By 1971, Extension was prepared to initiate pest management demonstrations with farmers in several states.

Objectives of IPM

The objectives of the Extension Integrated Pest Management Program (IPM) are to:

1. Develop and implement an effective, integrated program to prevent or mitigate losses caused by pests through use of biological, cultural, chemical, and varietal methods of control.
2. Develop methods for monitoring pest populations in farmers' fields.
3. Provide producers and those who advise farmers with information and training in the principles of IPM.

The goal of the Extension education pilot projects is to teach farmers, ranchers, and home owners how to carry out more effective pest control; protect natural enemies; implement, where feasible, nonchemical means of controlling pests; and apply pesticides on an as-needed basis. The program has been designed to:

1. Hasten the establishment of IPM programs in states where progress has been slow, or where such programs are lacking.
2. Broaden the scope of existing programs to include additional commodities and pests and accelerate the technology transfer process.
3. Improve pest management services offered by the private sector.

History of the IPM Program

Cotton insect scouting on an organized basis started in Arkansas in about 1946. In 1968, a grower organization was formed in Scotland Neck, North Carolina, to spray for cotton insects on an as-needed basis that was determined by field scouting. In 1969, the Safford Valley Cotton Growers Cooperative, with guidance from the Arizona Cooperative Extension Service, launched a successful IPM program. It became the model for other cooperatives to follow.

The USDA funded Extension pest management program originated with two projects in 1972, one in Arizona for managing cotton insects, and the other in North Carolina on tobacco insects. In 1973, 3-year pilot projects were initiated on cotton insects in 14 states. In FY 1975 and 1976, sufficient increases were provided by Congress to allow

initiation of statewide educational programs for managing boll weevils and other cotton pests in Texas, Missouri, Oklahoma, Arkansas, Louisiana, Tennessee, Mississippi, Alabama, Georgia, South Carolina, and North Carolina. Growers are required to pay the costs of field scouting for insects, which averages about \$1.50 per acre.

Starting in 1973 and continuing through 1976, Extension began to expand the program to other major crops. These crops included corn, soybeans, rice, peanuts, tobacco, wheat, grain sorghum, alfalfa, potatoes, vegetables, citrus, pears, apples, peaches, and pecans.

In 1975 and 1976, in order to maintain progress already made, the "pilot projects" were renewed as "application projects" in order to teach additional farmers the principles of IPM, and to expand programs to cover additional pests. Renewals were made with the provision that farmers must pay the direct cost of monitoring pests in their fields, and USDA funds would be used for professional salaries and other program costs such as computer services, educational materials, and scout training.

At the outset, emphasis was placed on managing insects because of the great use of insecticides. As the projects were expanded, most included monitoring of diseases, weeds, and nematodes as well as insects. Most of the projects are now multidisciplinary in that the objective is to manage a complex of pests in multiple cropping systems involving two or more crops.

In 1978, all states will have the opportunity to initiate pilot pest management projects on commodities and pests of their choice. A minimum of \$25,000 of federal funds will be provided to each state for this purpose, with a maximum of \$115,000 to states with greatest pesticide use. Approved projects must meet USDA guidelines.

Organizing a State IPM Program

To carry out such a complex program, the Extension Service had to develop a new system of providing IPM information to farmers. An interdisciplinary State Pest Management Steering Committee with farmer representation is established in each state. This committee decides on the type of technology that is feasible to implement, establishes policies, and identifies the area of the state, crops, and pests to be included in the project. Also, the steering committee suggests grower fees and other financial and legal arrangements. During the

first year, federal funds can be used to augment grower fees needed for hiring scouts, but with the understanding that growers will eventually assume all costs attendant to scouting their fields. The ultimate objective is education and technical assistance rather than providing farmers with individual services.

Pilot projects that were extended into the demonstrational phase of the program (for a second 3-year period) require that growers must pay all direct costs of scouting fields. This cost has varied from less than \$1 per acre to more than \$8 per acre, depending upon the commodity and complex of pests involved. (Horticultural crops and small fields are the most expensive to scout.) A statewide pest management specialist (leader or coordinator) provides leadership and assistance to county agents and farmers. The county agent, along with state Extension specialists, and with local farm leadership, organizes either formal or informal associations of growers to carry out the project. Legal arrangements are drawn up between the participating growers and the state Extension Service.

The growers are responsible for recruiting scouts, collecting fees, paying the scouts, keeping records relating to scouting, and operating the association. The state Cooperative Extension Service is responsible for training growers, scouts, and private organizations who provide advice to farmers on IPM decisions. The state Extension Service may also provide participating farmers, other farmers in the community, consulting firms, and chemical industry fieldmen with training and information on IPM. This is done through publications, grower meetings, TV and radio, farm journals, and local newspapers.

Federal funds can be used to pay professional Extension salaries and travel costs, develop and purchase publications on IPM, provide program support in the form of supplies and assistance for data processing, and procure specialized communication and monitoring equipment. Frequently, federal funds are used to employ area or county pest management specialists who help the county agents provide farmers information on which to make decisions. Or, county agents can employ supervisors to work with scouts. In some cases, the growers pay the cost of scout supervisors. The cost of professional Extension personnel has been paid from public funds. These state projects are mutually agreed to by the state Extension Services and the U.S. Department of Agriculture because all Extension programs have financial commitments from federal, state, and county sources.

Scouts are trained in the identification of pests, techniques for monitoring field populations and recordkeeping. This requires 1 to 2 weeks training before field operations begin. Subsequently, one-half day per week training sessions are required throughout the season to maintain quality and introduce the scouts to new pests they will encounter as the season progresses.

Scouts do not make recommendations on pesticides or other pest control strategies to farmers. Each time the farmer's field is scouted, a copy of the scout's report is given to both the farmer and the county agent. A copy is retained by the state pest management leader to use in computer simulation or other program decisions and evaluations. If private consultants cooperate in the program, the consultant would receive a copy of the scout's report. A qualified professional who is either an Extension specialist, county agent, or private consultant then discusses the scout's findings with the grower. The grower has final responsibility for making the decision on the type of pest control he uses.

Records are maintained of the type of management practices employed by farmers so that progress of grower adoption of new practices can be evaluated. Where computer monitoring is feasible, information obtained from field scouting, along with weather and crop development data, is programed into university computers from which rapid feedback of recommendations can be made to county agents and others for transmittal to growers. Growers are reached by personal contact, mailed notices, and newsletters. Newsletters are usually provided to all growers in the area.

Program Accomplishments

Growers in a cotton insect pest management program typically use 2 to 4 fewer insecticide applications than nonparticipating growers. This often represents a 35 to 50 percent reduction in insecticide use, and net profits of \$25 to \$95 per acre, depending on insect population densities, timing of insecticide applications, and yield increases. In 1977, because there had been adequate educational support of the cotton insect management program, about one-half of U.S. cotton acreage is under some type of pest management program.

In the pilot pest management projects on other commodities, the pilot projects have shown that the number of applications and amount of pesticides can be reduced 30 to 70 percent in situations where unwarranted or poorly timed applications have previously occurred.

Depending on the pest complex and crops involved, there is a benefit-cost ratio of 4-1 to 10-1. The cost includes those of monitoring fields, advising farmers, and applying pest suppression methods. Only about 2 million cultivated acres are now under the pilot pest management program (for crops other than cotton), but with an adequately supported educational system the potential is about 85 percent of most cultivated fruit, forage, vegetable, and high value field crops.

A number of states have demonstrated prototype predictive models to more accurately forecast local pest outbreaks and provide farmers and pest management advisors with better decisionmaking capabilities. There is increasing acceptance of the programs and a willingness of farmers to pay the cost of monitoring field populations of pests either by hiring consultants or by forming grower owned pest management cooperatives.

An outgrowth of this pilot pest management program has been the development of many training and informational materials. States have developed educational materials to meet their local needs.

The Extension Service-USDA, working cooperatively with the states, has developed educational publications and teaching aids for diverse audiences. These include a leaflet on Integrated Pest Management--Saves Dollars and Environment, which gives information on the nature and benefits of the program. The Extension Service also published Establishing and Operating Grower-Owned Organizations for Integrated Pest Management for use with farmers and state Extension staffs. The Farmer Cooperative Service has published Cooperatives in Integrated Pest Management as a guide for farm leadership and managers of service cooperatives.

Eight 14 to 36-minute movies have been produced on IPM by the Extension Service. These cover corn, apples, alfalfa, pears, grain sorghum, peanuts, cotton, soybeans, and vegetables. The Extension Service has produced a 45-minute TV video-tape and a movie depicting the general principles and benefits of IPM. These visual aids are primarily designed for farmers but are instructive to other audiences.

The Extension Service has developed cooperative agreements with lead states to develop 13 regional IPM publications:

- Pest Management for Alfalfa Seed Production
- Tobacco Pest Management

- A Handbook for Cotton Scouting
- Apple Pest Management
- Pest Management for Potatoes
- Cotton Pest Management
- Alfalfa Pest Management
- Pest Management for Vegetables on the Eastern Shore
- Soybean Pest Management on the Eastern Shore
- Managing Short-Life of Peaches
- Pest Management for Corn in the Plain States
- Peanut Pest Management in the Southeast
- Corn Pest Management in the Midwest

In recent years, the Extension Committee on Organization and Policy (ECOP) has sponsored thirteen national workshops on IPM. More are planned.

The Extension IPM program has been widely acclaimed for its innovativeness and impact upon farmers, and it has accelerated research programs. Many Extension-trained professionals have entered the private consulting business or are working for cooperatives and the pesticide industry. The thousands of rural youth who have been trained as pest management scouts will become better farmers. Many are pursuing professional careers in the public service or are working in the private sector where they are creating profound changes in attitudes about pesticide use.

In 1973, there were fewer than 100 private consultants offering pest management advisory services to farmers. Today, the number exceeds 500. Before Extension undertook this program, there were fewer than a dozen service cooperatives that provided any kind of IPM advice, while today several dozen cooperatives and farm management firms provide pest management services. More are developing this capability as trained professionals become available.

Many states have developed improved pest diagnostic facilities such as mobile laboratories and diagnostic clinics. Most states conduct specialized courses on identification of pests and provide instruction on latest recommendations to pest control operators, aerial applicators, and pesticide salesmen. Growers are advised on selection of resistant varieties, cultural practices, and when to spray. Clinics are also held in a number of major cities to better inform home owners and home gardeners. The subject matter is interdisciplinary, involving plant pathology, entomology, weed science, and nematology. Extension plant pathologists have organized on a regional basis for the purpose of reporting and forecasting epidemics of diseases such as wheat rust, blights of corn, tomatoes, and potatoes.

Crop Protection Compared with Human Health Care

Integrated Pest Management has many similarities with human health services. It may be more complex because of the great number of species and crop varieties involved in protecting the health of plants and animals. Medical services deal with diseases, disorders, and pest-parasite interactions of only a single species--man.

A great variety of public and quasi-public health institutions provide research, services, and education at both the state and national levels. A sophisticated industry exists for research and development of chemical and biological pharmaceuticals. State and county health departments provide health services and education to physicians and the public. To provide human health care, thousands of medical specialists practice in public hospitals and clinics. There are hundreds of private and co-op type hospitals and clinics. Public and private medical insurance systems, including Medicare, are readily available to aid our citizens. A number of agencies regulate these diverse activities.

A similar but not so elaborately financed and staffed system exists in agriculture to protect the health of crops and animals. State and national agricultural agencies provide research, services, and education (academic teaching and noncredit Extension education). A highly efficient industry exists for research, development and sales of chemical pesticides. Industrial development of biological agents is in its infancy. Several thousand technical representatives and salesmen of manufacturing and retail industry advise farmers and sell crop protection products. This differs from human health care whose physicians cannot sell chemicals. There will be about 200,000 registered commercial applicators of pesticides in 1978, including aerial applicators, pest control operators, and others

who apply pesticides for hire. State Departments of Agriculture and several federal agencies regulate many of these activities. There are approximately 500 Extension specialists with assignments in the areas of crop and animal health as well as county agents who provide information; most specialists are located on university campuses. At the present time there are about 500 private consultants working independently or for farm service firms and farmers' cooperatives to provide advice and make recommendations on IPM, and most of these professionals have been in practice less than five years.

There are other interesting comparisons. For medical advice and recommendations, prescriptions and treatments--both chemical and nonchemical--we have a number of choices. Most citizens prefer private physicians who practice in local communities. Others, especially the more affluent, travel great distances to university medical centers and world renowned clinics for advice and treatment. Still others use county health facilities and company operated clinics. County nurses provide valuable services and education in the area of preventive health care.

The parallel situation in agriculture occurs when the more successful, usually large and affluent farmers, frequently travel great distances to university centers and research stations for consultation with Extension specialists or researchers to obtain the latest and most sophisticated assistance possible. However, most farmers rely on advice and counseling that is provided through their local county agricultural Extension office.

As in human medicine, a growing number of qualified private consultants and service firms and cooperatives provide pest management services, usually on a fee basis. This type of private sector enterprise must be encouraged and expanded so that it will become a major source of IPM advice and service. Today, their numbers are inadequate to meet the needs of farmers and home gardeners.

Because there are so few private and public pest management advisors, our agricultural system has depended heavily on the great number of pesticide industry sales and technical representatives, who are familiar with pests and the performance of their proprietary pesticides, to advise farmers on controlling pests. This has been a free service but it has been oriented almost exclusively to the use of a company's proprietary products. Objectivity can be questioned when a salesman recommends his proprietary chemical. However, few salesmen would

recommend a chemical knowing that it would not control the target pest.

Expansion of the Program

Extension now uses many methods in multiplying its educational program. These include: TV, radio, newspapers, farm and trade magazines, university and local meetings, individual counseling, group meetings, clinics and workshops, and farm demonstrations and pilot projects. The demonstration system relies heavily on community farm leaders, who provide information to their neighbors. USDA, State Agricultural Experiment Stations, and the State Cooperative Extension Services distribute publications on pest control; large numbers of these publications are distributed by commercial pesticide outlets and salesmen.

Individual contacts with farmers are educationally the most effective and preferred means of helping farmers, but Extension resources are insufficient to reach 2.8 million farmers by this method, and it is even more difficult to reach 32 million home gardeners by personal contact. Services of the county Extension offices are available to all, but because of the demand current pest control advice is limited to routine inquiries.

State Extension specialists carry out specialized educational programs, and serve as resource persons for county agents who might need assistance in handling unusual or new pest problems.

Experience with IPM and other Extension programs indicates that several years are required for most farmers to fully accept new technology. This is especially so for IPM because of the complex nature of the program. Also, it will take longer for small farmers to acquire the abilities and resources to adopt pest management practices without much assistance from Extension. Rapid expansion of the program will depend on availability of many additional trained personnel, including scouts, Extension county and area pest management agents, and private sector professionals.

Many farmers will employ private consultants or utilize their cooperatives' IPM services rather than monitor fields themselves for pests.

It will take no less than 10 years to implement a well-planned program, in a stepwise orderly process, to coincide with readiness of research technology and availability of university trained professionals. Also, this much time will be needed to develop the public and private sector

organizational structures to deliver the program. Job opportunities with Extension and with consulting firms and farmer cooperatives must approximate the number of students that can be trained by the colleges of agriculture. Extension will ultimately need 500-600 pest management agents and state specialists in addition to the existing staff.

Pest control education for farmers, especially for small farmers, can be improved in the future as more rapid communication systems are perfected and procured. Foremost on the list will be the development of English language computer programs that will make available information and solutions of complex pest problems at the county office level. This now requires consultation with Extension specialists or other university technical personnel. Better agricultural weather information, combined with developing new technologies for forecasting and predicting outbreaks of pests, will improve pest control and further advance IPM programs. Farmers will receive more sophisticated and precise information on how to manage pests and reduce losses, thereby increasing agricultural production and contributing to a better environment.

State Extension staffs will develop program training packages on IPM and train urban Extension horticultural agents. These materials will be used by county staffs to train paraprofessionals who work with home gardening programs in urban communities.

Extension must continue to train farmers, ranchers, and others on how to carry out more effective IPM programs. To perfect such a complex program, the Extension Service must continually develop innovative systems of delivering pest management information. The pilot project system was developed as the best method of introducing new technology and delivering pest management services.

The state Cooperative Extension Services will provide training to growers, scouts, and private organizations who offer advisory services to farmers, rather than rely on manufacturer's representatives and salesmen of pesticides. The State Extension Services will provide participating growers, other farmers, home gardeners, consulting firms, and chemical industry fieldmen with educational materials and information on IPM. Public funds will be used only to pay professional Extension costs; develop and purchase publications; provide program support in the form of supplies, clerical assistance for data collection, processing and forecasting of pest populations; and develop specialized communication and monitoring equipment.

Farmers who are the primary beneficiaries will pay an increasing proportion of the total cost through fees paid to private firms and service cooperatives. Where computer modeling is practical, information obtained from field scouting, along with the weather and crop development data, will be programed into university computers from which rapid feedback of recommendations can be made to county agents and others for transmittal to farmers.

Each state will have an interdisciplinary IPM Steering Committee and statewide coordinator who will be responsible for developing a state plan to progressively move from the demonstration phase into a statewide program. As the program moves into a new area, farmers will be organized to implement IPM. Initially, Extension will provide intensive training and assistance to farmers that will establish a demand that will be conducive to the subsequent operation of a farmers' cooperative or private consultants who offer IPM advisory services to farmers. After about 3 years, the intensive educational phase will be redirected into other areas of the state, but a county or area IPM agent will be needed in the original area(s) to provide continuing educational and technical assistance, which will assure steady improvement in the program.

In this manner the principles of IPM will be demonstrated to farmers, and a permanent system will be established to give farmers improved decisionmaking capability. Program development will coincide with the availability of trained personnel, and the basis for rapid transfer of new research technology will be firmly established.

Resources For the Future

A successful IPM educational program can be planned and developed with adequate financing over a 10-year period. In 1978, \$4.4 million of federal funds are provided the State Cooperative Extension Services to initiate pilot programs in all states. The following resource plan is based on an annual increase of about \$2 million through 1986. By 1986 the educational program could be well established with a federal support base of about \$20.4 million. ^{1/}

By 1980, the program could encompass 38 million acres of most major crops (table I). The percent of planted acres under IPM would vary from a low of 1 percent for wheat and rice to a high of about 75 per-

^{1/} These estimates of resources are based on analysis of current state programs and do not represent the position of the agency or the Department.

cent for cotton. Each year more than 30,000 scouts would be employed, and about one-half must receive up to 2 weeks training every year. Depending on the crop, grower fees will range from \$1.50 to \$20 per acre. Growers will pay about \$115 million to consulting firms and cooperatives for IPM advisory services.

By 1986, there could be 109 million acres under IPM. The percentage of acres in the program will dramatically increase (table 2), especially on commodities where pilot projects have existed for several years. Over one-half of the acres of cotton, corn, peanuts, tobacco, soybeans, fruit and nuts, and grain sorghum could reach proportions that approach the potential for each crop.

The efficiency of scouting will increase because of refinements in thresholds and monitoring techniques. Nonetheless, approximately 63,000 scouts will be involved in the program if quality is maintained. The number of scouts that must be recruited and trained is critical for success and indicates the urgent need for research on thresholds and monitoring techniques, especially for automated data collection, computer modeling, and more rapid communication systems. Growers will pay higher per acre fees because the program will provide IPM services on a greater number of pest species. The estimated grower cost in 1986 will be \$566 million.

An outgrowth of this program will be the creation of new job opportunities. Thousands of youth will be provided training, summer employment, and career opportunities.

The federal cost (ES-USDA) will be \$8.4 million in 1980 and \$20.4 million in 1986 (table 3). This will provide for training scouts, data handling, 53 state and federal IPM coordinators, and 105 area Extension IPM agents in 1980. The number of area IPM agents will increase to 330 in 1986 to serve 3,000 counties.

As the program develops, the state Extension Services, through reallocation of regular funds, or from fund increases from state and local governments, will provide an average of 4 specialists per state from crop protection disciplines (entomology, plant pathology, nematology, weed science, and others) at a cost of about \$8 million. The participation of these interdisciplinary specialists (200) is essential and will assure integration of control methods needed to manage complexes of pests.

Conservatively, more than 1,900 private-sector advisors (consultants from firms and cooperatives) will be needed to manage 38 million

acres in 1980. This assumes that each consultant can care for 20,000 acres. By 1986, with increased efficiency, 3,633 advisors will be needed to handle about 109 million acres. Growers will pay for the services of consultants.

Based on data on pesticide sales in the past few years, without an IPM program, the value of pesticide sales could reach \$6.3 billion by 1986 (11 percent annual increase) (table 4). It was \$1.8 billion in 1974. By 1986, the pounds of pesticide products sold will reach 2.6 billion pounds (6 percent annual increase). There were 1.3 billion pounds of pesticides sold in 1974. An effective IPM program could reduce these sales by 30 percent--a savings of \$1.8 billion and a reduction of 0.8 billion pounds of pesticides. Farmers would spend \$566 million on IPM instead of pesticides. Public cost of IPM would be \$28.4 million. Therefore, the net savings over cost would be \$1.2 billion annually above public cost of the program and grower fees for IPM services.

TABLE 1. SCOPE OF IPM IN 1980

Crops	Percent of Acres Planted	Acres In IPM (1,000) ¹	Acres per Scout	Number of Scouts	Grower Costs	
					Dollar/ Acre	Dollars (Million)
Cotton	75	5,625	1,200	4,690	3.50	19.7
Corn	15	11,685	1,500	7,790	2.00	23.4
Peanuts	40	612	600	1,020	10.00	6.0
Tobacco	30	325	100	3,250	15.00	4.9
Sugarbeets	5	80	1,000	80	4.00	.3
Sugarcane	2	15	1,500	100	1.50	.2
Soybeans	5	2,728	1,000	2,728	3.50	9.5
Potatoes	10	129	400	320	6.00	7.7
Vegetables	10	338	300	1,130	15.00	5.1
Fruits and Nuts	40	11,172	200	5,860	20.00	23.4
Rice	1	28	1,000	28	3.00	.1
Wheat	1	751	2,500	300	1.50	1.1
Grain Sorghum	10	1,827	2,000	910	1.50	2.7
Alfalfa	10	2,706	1,000	2,706	4.00	10.8
TOTALS		38,021		30,912		114.9

¹Based on USDA Agricultural Statistics, 1976.

TABLE 2. SCOPE OF IPM IN 1986

Crops	Percent of Acres Planted	Acres In IPM (1,000) ¹	Acres per Scout	Number of Scouts ²	Grower Costs	
					Dollar/Acre ³	Dollars (Million)
Cotton	85	8,069	2,400	3,362	4.50	36.3
Corn	50	38,951	3,000	12,984	4.00	155.8
Peanuts	75	1,149	1,000	1,149	12.00	13.8
Tobacco	85	923	150	6,153	20.00	18.5
Sugarbeets	20	318	2,000	159	5.00	1.6
Sugarcane	15	110	2,000	55	2.00	.2
Soybeans	50	27,238	2,000	13,619	4.50	122.6
Potatoes	60	779	700	1,123	8.00	6.2
Vegetables	30	1,014	400	2,535	25.00	25.4
Fruits and Nuts	85	2,489	300	8,297	30.00	74.7
Rice	5	140	1,200	117	3.50	.5
Wheat	5	3,754	3,000	1,251	2.00	7.5
Grain Sorghum	60	10,962	3,000	3,654	2.00	21.9
Alfalfa	50	13,529	1,500	9,019	6.00	81.2
TOTALS		109,425		63,477		566.2

¹Based on USDA Agricultural Statistics, 1976.

²Variable increase in scouting efficiency, introduction of other monitoring methods for each crop over 1980 level.

³Increase in grower fees due to inflation and increase in number of pests monitored.

TABLE 3. COSTS OF IPM PROGRAMS

SOURCE OF SUPPORT	YEAR	
	1980	1986
<u>Extension Service/USDA</u>		
Train one-half of required scouts, two week sessions annually (\$100 each; CES supplies travel, etc. - scouts pay meals and lodging).	\$1,545,600	\$ 3,173,850
State and USDA IPM Coordinators 53 x \$35,000	1,855,000	1,855,000
Area or County IPM Agents 105 x \$35,000	3,675,000	--
330 x \$40,000	--	13,200,000
Educational Materials and Data Processing	<u>1,324,400</u>	<u>2,171,150</u>
TOTALS	\$8,400,000	\$20,400,000
<u>State Cooperative Extension Service</u>		
Supporting Interdisciplinary State Specialists (4 per state) 60 x \$35,000	\$2,100,000	--
200 x \$40,000	--	\$8,000,000
<u>Farmer's Fees Paid to Private Sector IPM Advisors</u>		
1,900 Advisors to handle 38-million acres (20,000 acres each)	\$114,900,000	--
3,633 Advisors to handle 109-million acres (30,000 acres each)	--	\$566,200,000

TABLE 4. PROJECTED USE OF SYNTHETIC,
ORGANIC PESTICIDES 1974 - 1986

YEAR	DOLLARS (billion)	POUNDS (billion)
1974	1.8 ¹	1.3 ²
1975	2.0	1.4
1976	2.2	1.5
1977	2.5	1.5
1978	2.7	1.6
1979	3.0	1.7
1980	3.4	1.8
1981	3.7	2.0
1982	4.1	2.1
1983	4.6	2.2
1984	5.1	2.3
1985	5.7	2.5
1986	6.3	2.6

¹Sales of pesticides (manufacturer's level) based on 11% annual increase.

²Sales of products based on 6% annual increase.

